



Joint Service Solvent Substitution (JS3)



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

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**Joint Service
Solvent Substitution
Working Group**

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- “Standard Protocol for Selecting General Cleaning Agents and Processes” Oct 1996
- “Performance Test of ChemFree Enzyme-Based Aqueous Solvent”, Feb 1999
- “Armed Services Test Protocol for Alternative Cleaner Performance Validation” May 1999



- “USN/USMC Aqueous Weapons Cleaner Test Protocol”, February 2000



Observations & Lessons

Selecting An Alternative Cleaning Process

- Misinformation Abounds and Therefore Education is Critical
- Cleaning Must Be Evaluated as Part of a Process – Not a Stand Alone Operation
- Know Your Process & Define Your Requirements (Not the Performance of Your Current Cleaner)

Evaluating Alternative Cleaning Processes

- Some Criteria Are Difficult to Use in Evaluation or Did Not Allow for a Full Indication of Results
- Procurement of Test Coupons Can Be a Bottleneck
- It Is Difficult to Identify Methods for Evaluating Properties Like Cleanliness and Odor
- There Is a Uncomfortable Balance to Maintain Between Technical Requirements & Economic Realities

- Microbial Bio-Remediating
- Aqueous Alkaline Cleaner with d-Limonene
- High Pressure Steam Cleaner

2001 P2 Conference:
Charles Sokol

NAVAL FACILITIES ENGINEERING SERVICE CENTER

- From discussion at Solvent Substitution Workshop → Joint Service Solvent WG
 - Wayne Ziegler (ATC)
 - Andy Del Collo (NAVFAC)
 - Debora Meredith (AFMC)
 - Gerry Mongelli (CTC supporting AFMC)
 - Dr. Katherine Ford (NFESC)
 - Dan Verdonik (representing AAPPSSO & DoD NESHAP Subcommittee)
- “largest contribution of HAPs at DoD facilities stems from hand wipe cleaning with solvents”

- Across services 30-35% of P2 needs are related to cleaning applications
- “Increasing compliance requirements causing major impact to manufacturing and maintenance operations” Focus on Cleaning, *Policy and Strategy for Seeking Common Solutions*, Chairman JGPP
- DoD has focused on regulated chemicals, waste management & VOC reductions not HAPs
- 55 DoD Installations are Major HAP Sources
- Multiple NESHAPs may apply to the same system
- Cleaning & repainting technologies have the greatest potential to significantly reduce NESHAP burden



Joint Service Solvent Substitution Working Group

Communication
Collaboration
Coordination



- **Methodology**
- **Information Exchanges**
- **Project Coordination**
- **Project Database**



Targeted Processes

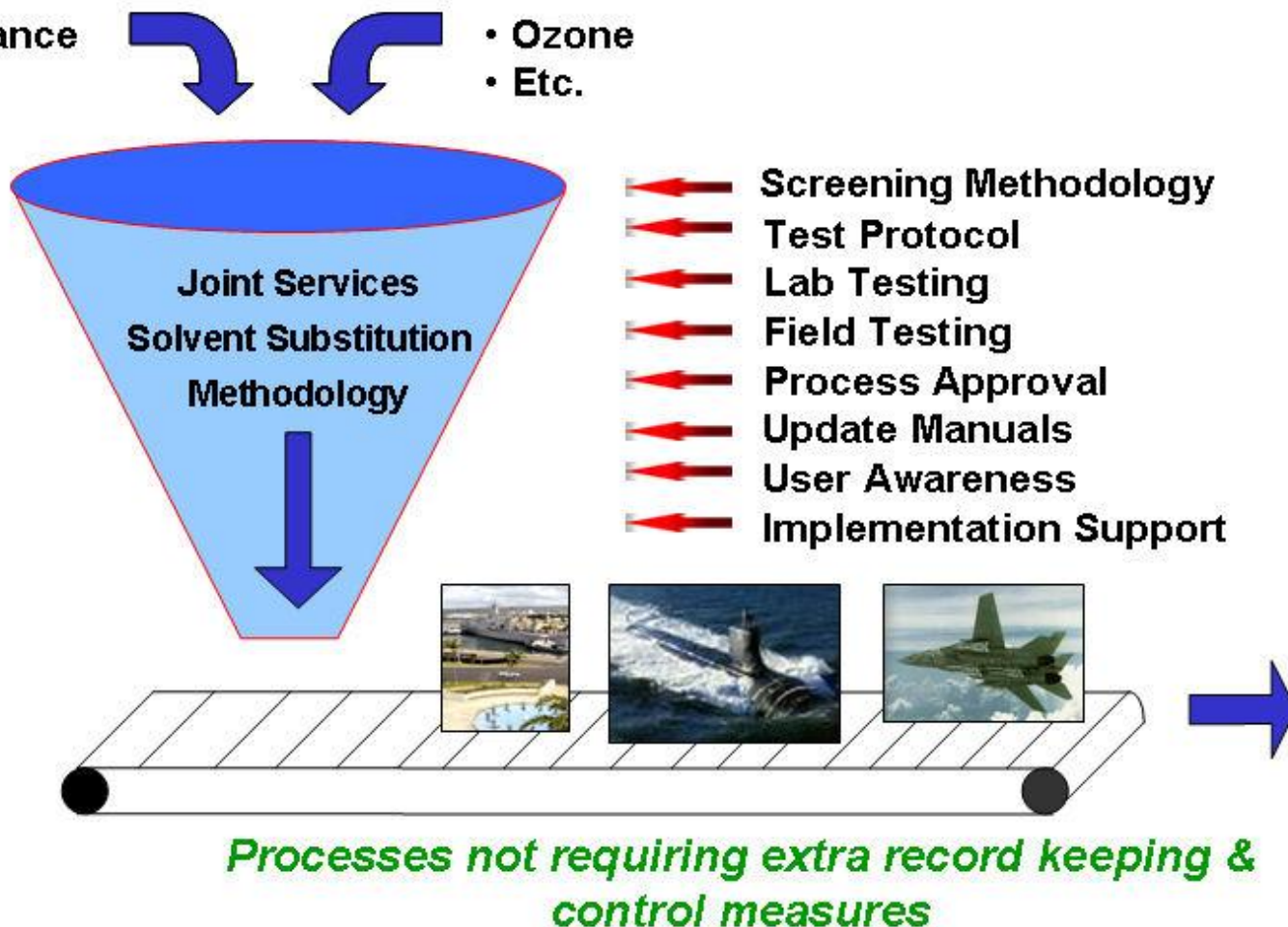
- Aircraft Maintenance
- Ship Maintenance
- Facility Maintenance
- Etc.

Candidate Solutions

- Aqueous Solvents
- Biobased Solvents
- Ozone
- Etc.

Partners

- NAVSEA
- NAVAIR
- Marine Corps
- Army
- Air Force
- NASA



Requirement

Targeted Processes

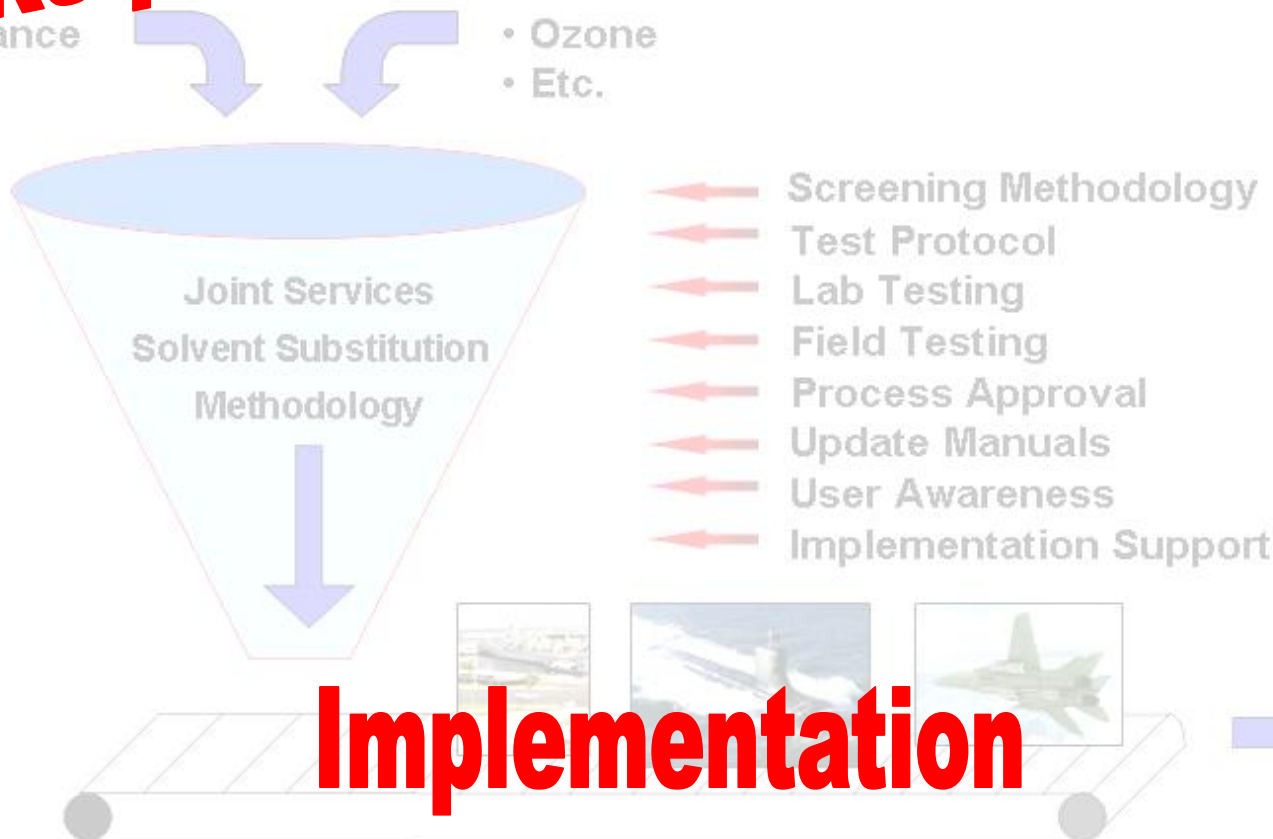
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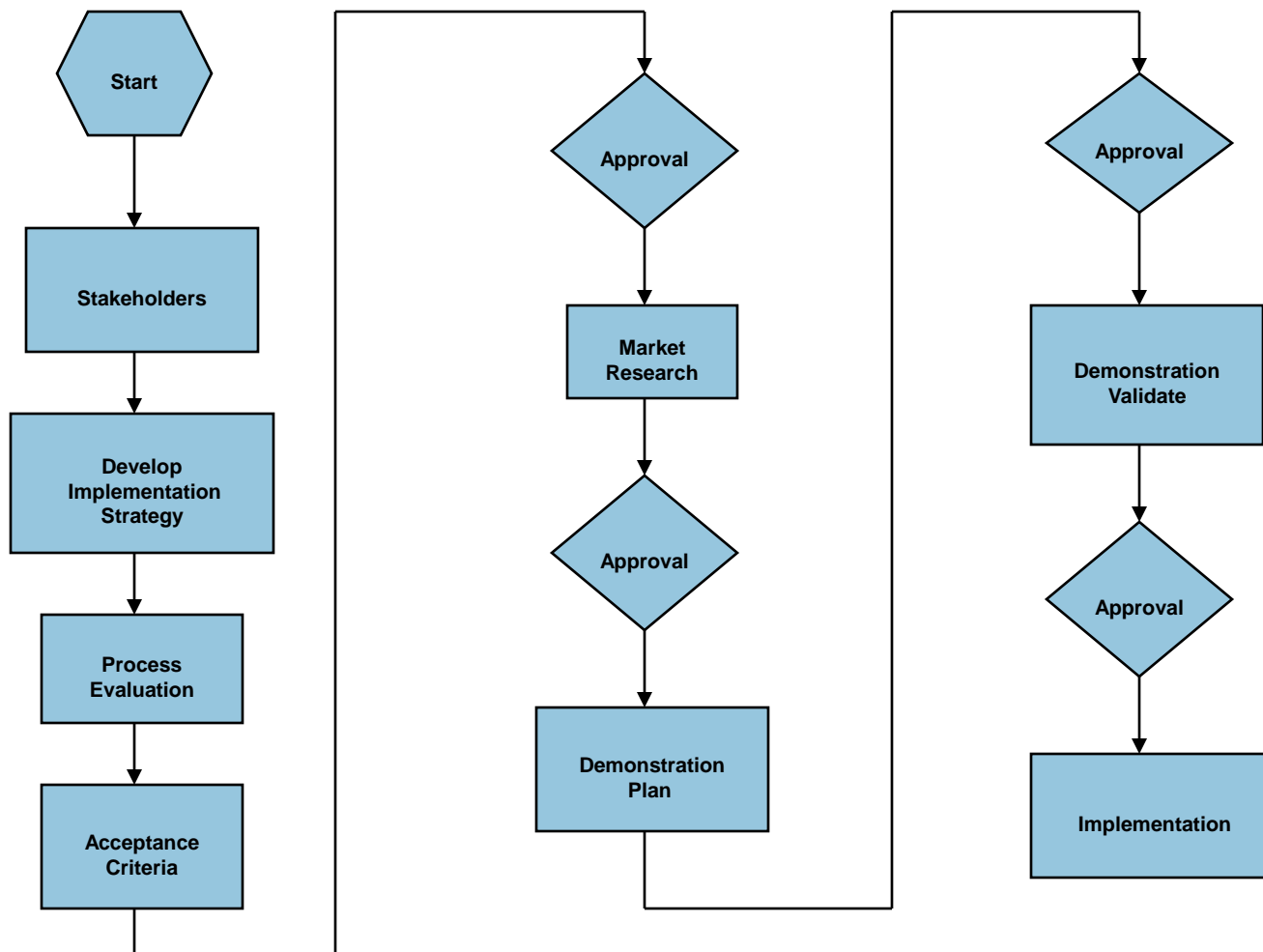
Partners

- NAVSEA
- NAVAIR
- Marine Corps
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- Air Force
- NASA



Processes not requiring extra record keeping & control measures

- 
- **All cleaning applications are not equivalent**
 - **Define the cleaning process**
 - **Regulations continue to evolve**
 - **Focus on capability and cost**



- **Define performance**
- **Pursue the possible**
- **Focus on implementation**
- **Engage the user & understand their perspective**
- **Grow champions**

- Objective: demonstrate the efficacy and validate the economic and process impact of TBAC solvent as alternative
- Norfolk Naval Shipyard
 - T10 thinner alternative for paint gun cleaning
- MCLB Albany
 - Paint thinning, paint clean up and gun flushing
- Corpus Christi
 - Pre-paint tack wipe solvent

- Process Cleaning
 - 2006; Efforts of DoD Services and NASA Towards Green Cleaning Operations
 - 2010; Environmentally Responsible Cleaning Processes for Military Applications
- Handbook on Critical Cleaning
 - Ed. 1 Implementation of Environmentally Preferable Cleaning Processes for Military Applications
 - Vol. 2

- Laboratory screening
- Demonstrations
 - Anniston
 - Corpus Christi
 - Letterkenny
- Small Program Award



Navy Efforts



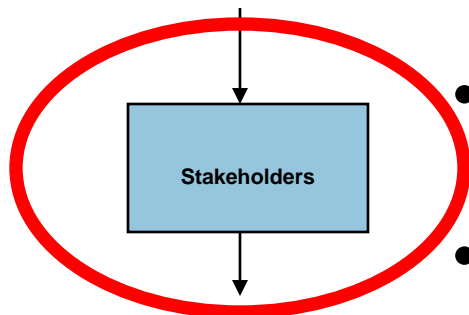
- SERDP – Cleaning with Ionic Liquids
- ESTCP – nPB Vapor Degreasing full scale demonstration

- **Role**
 - **Provide tools**
 - **Expertise**
 - **Collaboration**
- **Clearinghouse for challenges and solutions**

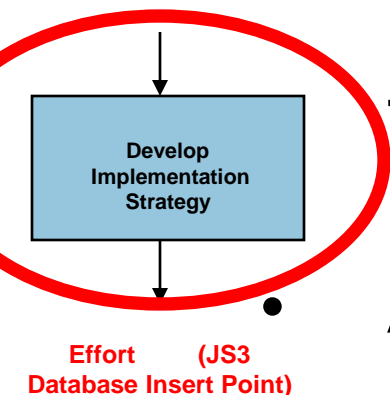


Backup Slides





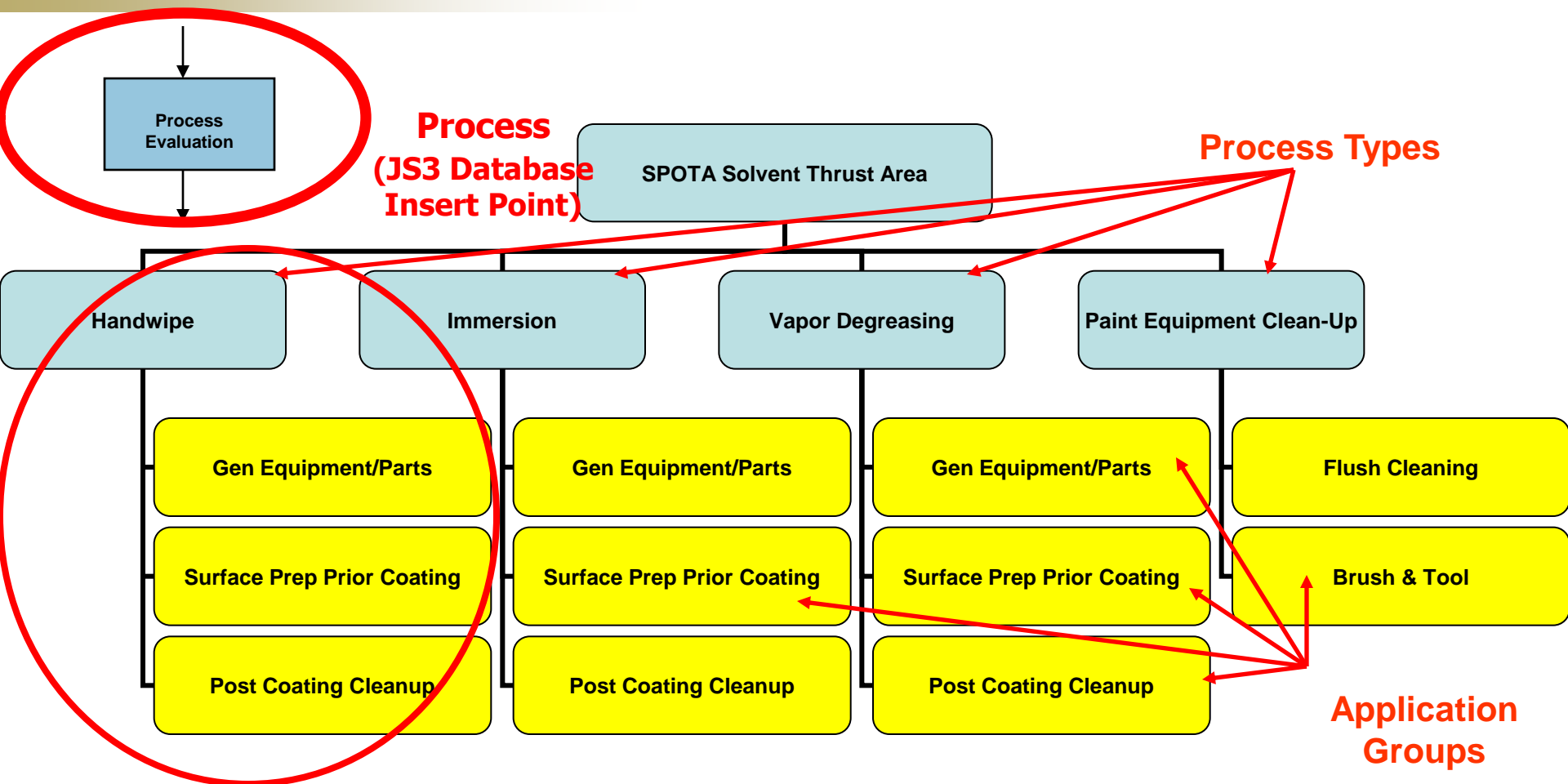
- Engage multiple end users simultaneously
- ARL - research & development, lead
- ATC - test & evaluation
- AMCOM/AMRDEC - aviation
- ECBC - chemical & biological
- ERDC - corp of engineers
- JMC - munitions
- TACOM/TARDEC – ground vehicles
- TACOM/ARDEC - armaments



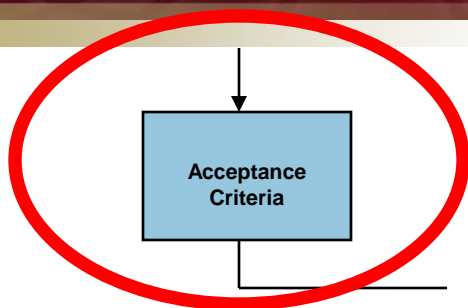
The Army strategy for addressing issues related to NESHAPs

- Army's #1 Priority under Army Environmental Requirements and Technology Assessments (AERTA)
- Army Environmental Quality Technology (EQT)
- ESO Lead
- Purpose – to ensure continued operations at impacted Army facilities

1. Site-by-site Assessment – Identify & Quantify
2. Best Practices Survey
3. Technology Gap Assessment
4. Develop Technology Roadmaps
5. Material and Technology Criteria Establishment
6. Laboratory Validation of Material Solutions
7. Demonstration of Material Solutions
8. Implementation of Accepted Solutions



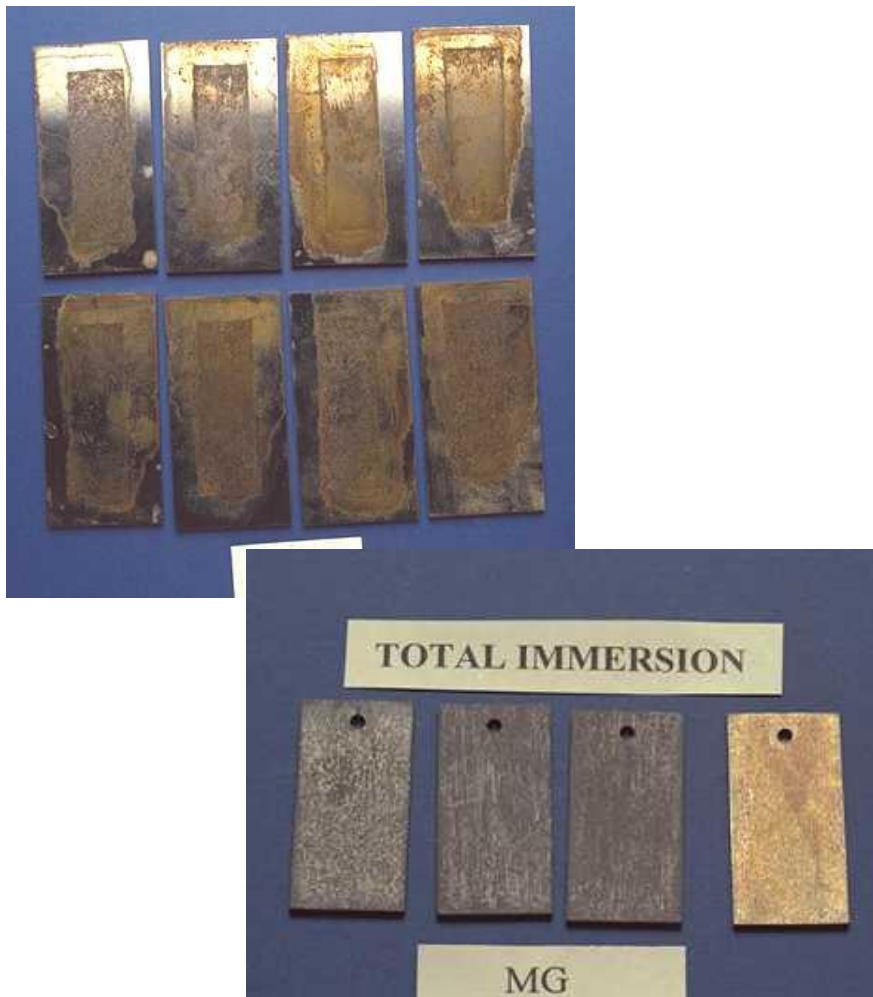
Application and processes identified by SPOTA Assessment and Technology Gap reports. Alternatives for each of the eleven application/process groups will be identified and validated as required.



Environmental, Safety and Occupational Health, and Chemical Parameters

	Parameter
Environmental Screening	HAPS
	VOC
	Ozone Depleting Substance
	Ozone Forming Potential
	Global Warming
Occupational	PEL
	Toxicity
	Objectionable Odor
Chemical Property Screening	Temperature Stability
	Low Temp Stability
	Specific Gravity
	Flash Point
	Kari-Butanol Value
	Vapor Pressure
	Chemical Content Limits

Material Compatibility Test Types



- Total Immersion
- Effects on Polysulfide Sealants
- Elevated Temp Corrosion
- Effects on Acrylics
- Effects on Unpainted Surfaces
- Effects on Polycarbonate
- Effects on Painted Surfaces
- Effects on SMC
- Effects on Rubber
- Sealant Adhesion
- Adhesive Bonding
- Fluorescent Penetrant
- Hydrogen Embrittlement
- Sandwich Corrosion
- Titanium Stress Corrosion
- Stress Corrosion
- Effects on Polyamide Wire
- Low Embrittling Cadmium Plate Corrosion
- Copper Corrosion

- Visual Inspection
- Wipe Test (White Glove Test)
- Water Break Test
- Soil cleaning per MIL-PRF-680
- ASTM-G 122 Standard Test
- Non-Volatile Residue



Hand wipe Cleaning Criteria

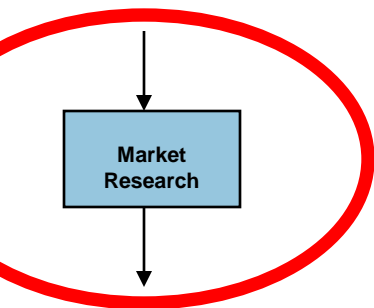


Property/Substrate

Test Method

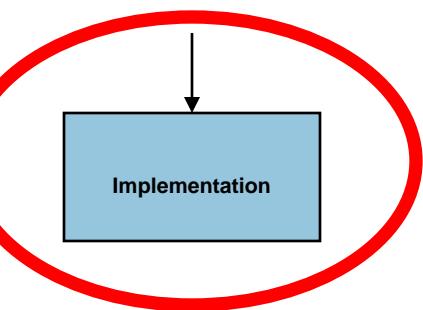
Criteria by Application Group

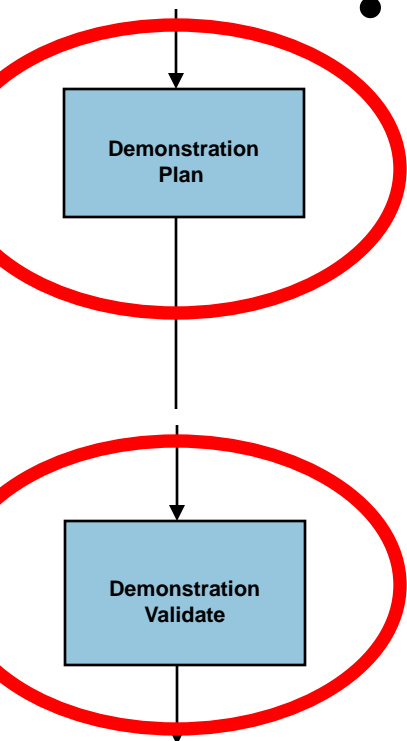
Test Name	Test Number	Units	1
Total Immersion	ASTM F-483		X
	MIL-PRF-63460D		
Mg (AZ 31B-H24)		mg/cm ²	0.7
Mg (SAE AMS 4377)		"	
Al (AMS-QQ-A-250)		"	
Al (7075-T6)		"	0.49
Ti (AMS 4911, 6AL-4V)		"	0.35
Steel (AMS 5046, grade 1020)		"	
Steel (4340)		"	0.49
AM-355 CRT		"	0.49
PH 13-8 Mo		"	0.49
Maraging C-250		"	0.49
Zinc (ASTM B 852)		"	
Brass (ASTM B 121 C35600)		"	
Steel (ASTM A 36)		"	
Cadmium (A-A-51126)		"	
Effects on Polysulfide Sealants	PRF 61 4.5.13	ShoreA units	no change 5 Shore



- Candidate alternatives identified by:
 - SPOTA Usage Alternatives Report
 - Army Alternative Cleaner Program Candidates
 - QPLs & Approved Products
- Initial alternative down select
 - Current approvals/QPLs
 - ESOH properties
 - Evaluation of vendor test results
 - Industry experience
 - DOD Aerospace & Shipbuilding NESHAP experience

- Engage multiple end users groups simultaneously
- Members from:
 - SPOTA team
 - RD&E Centers
 - PEO/PM Offices
 - Site Specific Members





Dem/Val Plan
(JS3 Database Insert
Point)

- ASSWG members identifying demo sites base on:
 - Pervasiveness of the application
 - Identify key facilities and individuals who are in a position to champion the alternative cleaners
 - Identify cooperative PM and PEO offices
- Key Issue
 - Workload at key sites

PERFORMANCE SPECIFICATION

**CLEANER, GENERAL, FOR MILITARY
SYSTEMS, LOW OR EXEMPT VOC,
HAP-FREE**



